

# Individual assignment

**Size:** at least 30 hours to be spent

**Deadline:** friday 25 january 2008

## Automatic segmentation by thresholding

For many images, a meaningful segmentation can be created by thresholding it. Please read section [10.1](#) (and the introduction of chapter 10) of the reader for an introduction to general segmentation and threshold based segmentation in particular.

An image may be segmented by placing  $K$  thresholds at the local minima of the histogram, creating  $K+1$  segments. This method often works poorly because the histogram can be noisy, creating too many local minima, drowning out the 'correct' ones. Your assignment is to try and correct for this problem somehow. A possible approach is to smooth the histogram first, or estimate it in such a way that it is already smooth, *e.g.* using Parzen windowing as described in section 10.1. But you are encouraged to devise your own modification of the 'minima-thresholding' method to improve the resulting segmentation. You may implement anything you can find or think of here, but smarter, original and/or better improvements of course get more credits...

**Assignment:** Implement your improved 'minima-thresholding' method using Java or C/C++. Given a number of segments  $K$ , your program should be able to read a greyscale image (in a standard format such as jpg, bmp, or tiff), perform the improved 'minima-thresholding', and write the segmented image to disk. For comparison, your program should also be able to do 'standard' (unimproved) histogram minima thresholding.

**Deliverables:** (1) the complete source code of your program, (2) an **executable** of your program, (3) one page (no more) with a user manual of your program and a short description of your improvement.

All deliverables are to be handed in on **physical** media (paper and CD), not by email or weblinks. This measure is tedious, but necessary, since some assignments (if you include libraries, test images, etc.) tend to bloat beyond a mailable size. Note that the deadline is a hard deadline for handing in the physical media. Don't send mail on the last day with all deliverables attached and saying the physical media will be handed in later. Mark all deliverables clearly with your name and student number.

The executable can be an .exe or a .jar file. If you hand in a jar file, please check carefully that it will execute on a machine with only a basic java installation, *i.e.* make sure there are no dependencies on system variables or external libraries. In the past years students mentioned (in Dutch) [this](#) and [this](#) regarding jar file creation, which may be useful.

You are allowed to use third party libraries for the reading/writing of images, displaying of images (if you use a GUI), etc. You are actually encouraged to do this; there's no need to re-invent the wheel. The thresholding/improvement part should of course be entirely your own code. Your program preferably has a GUI, but a

command-line version is acceptable.

**Alternative assignment:** for students that do not do a major/minor/master program of computer science (and only those!), an alternative assignment is to hand in (on paper) a literature survey of **K-means clustering** for image segmentation. If you choose this alternative, please make sure your survey conforms to the standards for a scientific paper, as (e.g.) stated in the course '[overdragen van informatica-onderzoek](#)'.